ANAESTHESIA FOR TRAUMATIC PNEUMO-CEPHALUS — USE OF TOTAL INTRAVENOUS ALTHESIN

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SYNOPSIS

A 26-year old worker was admitted after being hit on the side of his head by a pneumatic compressor. The anaesthetic problems that presented were two-fold — difficulty in intubation due to injuries of the jaw and the problem of anaesthetising a patient with traumatic pneumo-cephalus. This case report describes the use of total intra-venous Althesin in the anaesthetic management of this case.

INTRODUCTION

The problem of anaesthetising a patient who has air in the ventricles was described by Hunter in 1972. Nitrous oxide (N_2O), the manistay of anaesthetic practice, is 34 times more diffusable than nitrogen. That being the case, an air filled cavity will tend to expand as N_2O diffuse into it 34 times faster than nitrogen can diffuse out. As a consequence, the volume of a gas filled cavity will expand, often with disastrous increases in intra-cranial pressure.
cases appears to be a suitable alternative to controlled ventilation using N_2O — O_2 mixtures. That technique must however be safe, uncomplicated to administer and be compatible with the demands of neuro-anaesthesia.

CASE HISTORY

TCS, a 28-year old worker was admitted to Alexandra Hospital after being hit on the head by a pneumatic compressor. He was said to have lost consciousness but on admission, he had recovered but was drowsy. His blood pressure remained between 110/60 mm. Hg. and 160/90mm. Hg. His pulse rate remained around 54/min., was regular and of good volume.

There was considerable bleeding from the nose and mouth which, together with his drowsy state, tended to embarrass respiration. There was a noticable depression on the left parieto-temporal region. The left tempero-mandibular complex was driven in and there was obvious dislocation of the right tempero-mandibular joint. The patient could not open his jaw to allow further examination.

The left pupil was slightly larger than the right and reacted sluggishly to light. There were no other neurological findings of significance.

A pre-operative skull X-ray showed a line fracture of the left frontal bone, depressed fracture of the left parieto-temporal bone, fracture of the left malar bone with medial displacement, fracture of the left malar arch, right-ward displacement of the mandible and dislocation of the right tempero-mandibular joint. (Fig. 1).

A CT-scan showed multiple air pockets in the sub-arachnoid space. (Fig. 2, 3, 4) No intra-cranial haematoma were demonstrated.

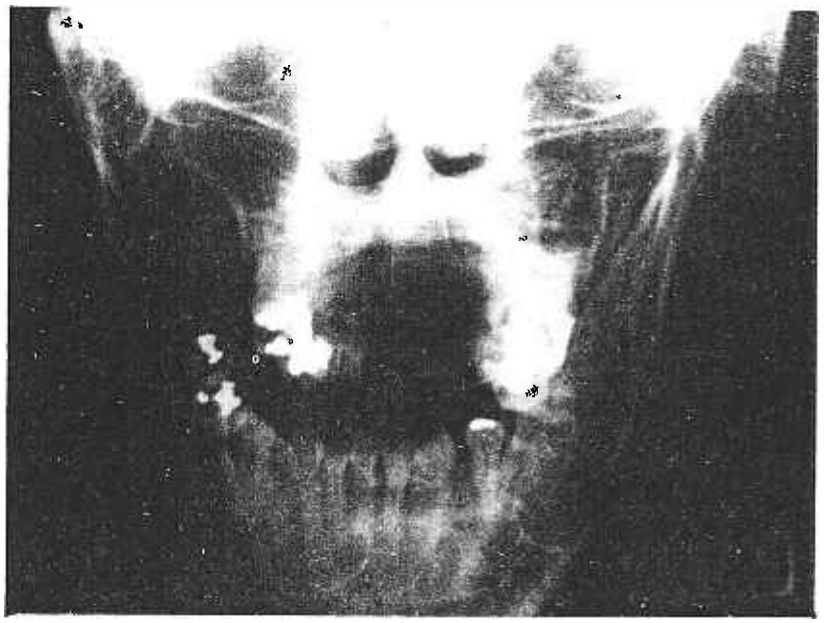

Figure 1. — Pre-operative Skull X-Ray

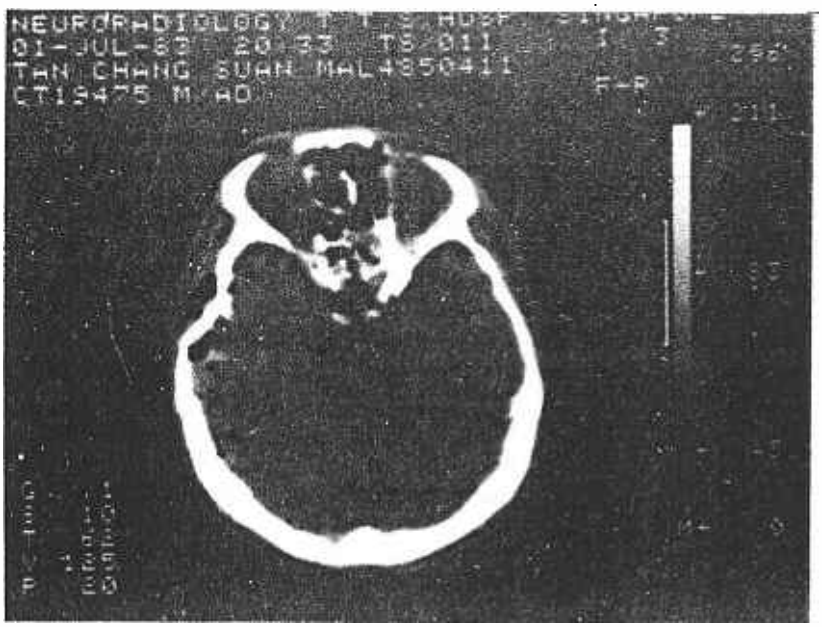

Figure 2. — Pre-operative CT-scan at position 20

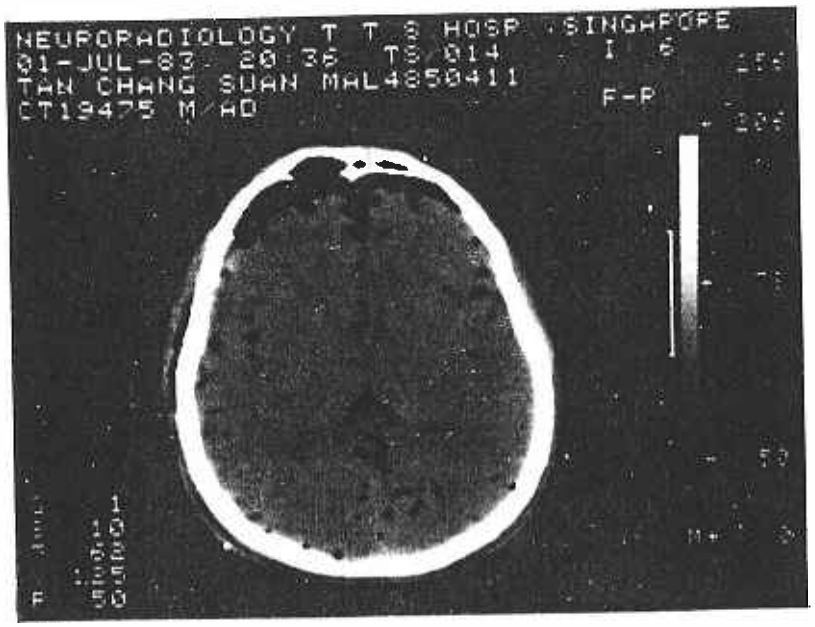

Figure 3. — Pre-operative CT-scan at position 50

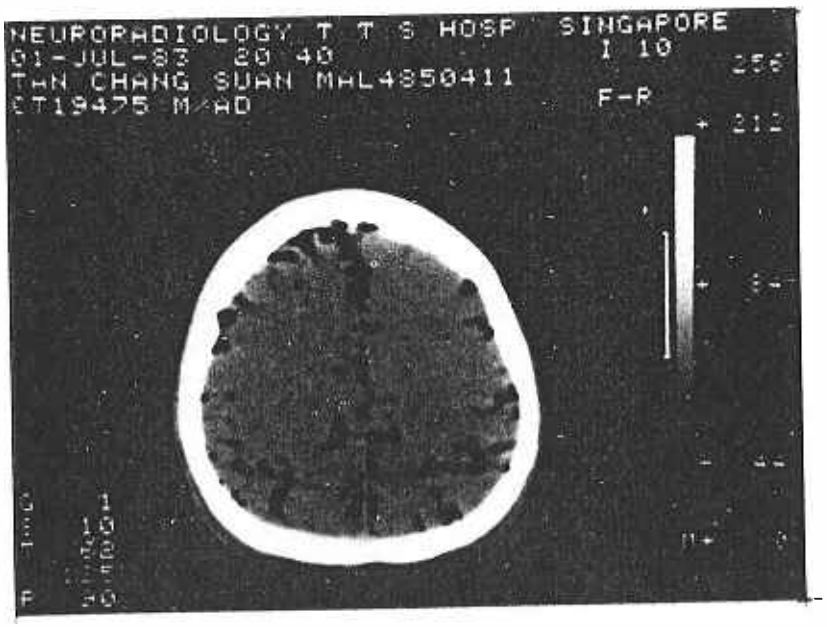

Figure 4. — Pre-operative CT-scan at position 90

A pre-operative chest X-ray demonstrated an incidental finding of a fluffy opacity with a hint of cavitation. Lung markings were increased.

The patient was sent to the operating theatre without pre-medication. He was immediately placed in the right lateral position and his oro-pharynx and naso-pharynx immediately sucked out. After 5 min. of pre-oxygenation, a bolus intravenous dose of 0.1 mg Fentanyl was administered. This was immediately followed by a 'crash' induction of 250 mg. of Thiopentone and 75 mg. of succinyl di-choline. Intubation was attempted after the muscular fasiculations had subsided. Laryngoscopy was surprisingly easy and the vocal cords clearly visualised. After pharyngeal suction, the vocal cords and trachea were sprayed with 4% Lignocaine and a size #9 Oxoford endo-tracheal tube was introduced.

The patient was ventilated with 100% 02 via a Mapleson D circuit driven by a Penlon 200 ventilator. The settings were adjusted to deliver a fresh gas flow of 8 litres/min, a tidal volume of 500 ml/breath and a respiratory rate of 12 breaths/min. With these ventilation parameters, it wa possible to keep the end-tidal CO_2 (monitored continuously with the Siemans CO_2 monitor, Model 130) within 30-35 mm. Hg.

Anaesthesia was maintained by a continuous intravenous infusion of Althesin of 10 ml/hr. The infusion was started immediately after induction and continued for the duration of the whole operation.

The patient's ECG was continuously monitored. From a pre-induction rate of 50-60 bpm. it rose to 100 opm. during skin incision. Thls, however responded to a further dose of 0.05 mg. Fentanyl and settled to approximately 80 bpm. Similarly, the blood pressure (measured aneroid sphygmanometer) rose from a pre-induction level of 100-110 mm. Hg. systolic to 150 mm. Hg. during skin incision. This rapidly settled back to pre-induction levels after the supplement of Fentanyl.

Approximately 2 hours later, during the beginning of skin closure, the blood pressure and the pulse rate began to climb again. A further dose of 0.05 mg. Fentanyl brought the blood pressure and pulse rate under control. No further fluctuations were observed.

The Althesin infusion was stopped immediately after the last skin stitch was put in and anaesthesia was reversed in the usual manner. The patient awoke within 10 min. of stopping the infusion and was extubated almost immediately after regaining consciousness.

On the 5th post-operative day, the patient complained of a fever and headache. A repeat CT-scan, showed considerably less air within the intra-cranial space. (Fig. 5, 6) On the 8th post-operative day, however, the patient developed CSF rhinorrhoea, from which cultures grew Pseudomonas aeruginosa. Immediate treatment for meningitis was started, and the patient reoperated on to seal the leak. A conventional Thiopentone — muscle relaxant — N_2O anaesthetic sequence was administered for this operation which proceeded uneventfully.

Subsequent post-operative recovery was unevenful.

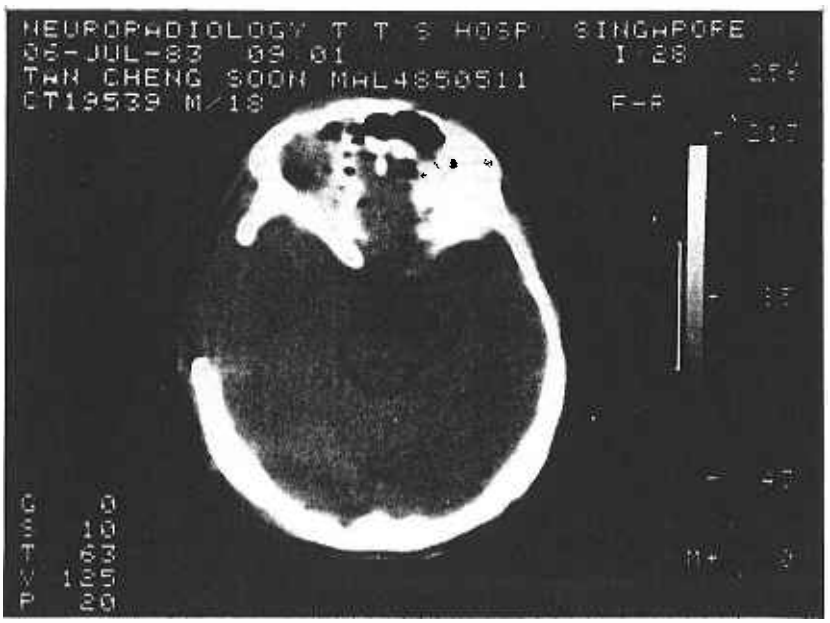

Figure 5. — Post-operative CT-scan at position 20

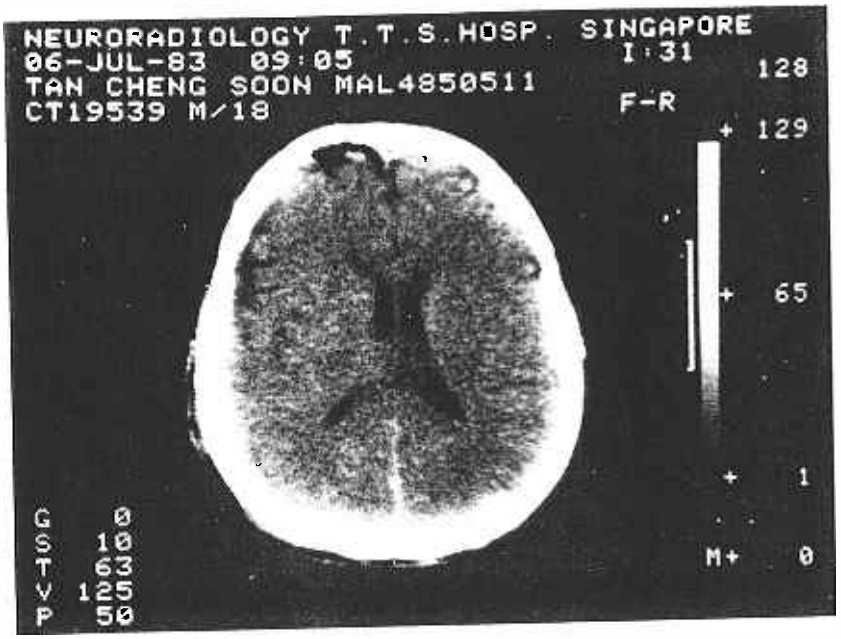

Figure 6. — Post-operative CT-scan at position 50

DISCUSSION

N_2O, the most commonly used anaesthetic gas, has a blood/gas partition coefficient of 0.474, while that of N_2 is 0.014. This means to say that at equilibrium, the partial pressure of N_2O is 34 times that of N_2 in blood. Thus, when the blood perfuses an air filled cavity, Graham's Law of Diffision is obeyed and N_2O diffuses into the cavity 34 times faster than N_2 can leave it. The nett effect is that the cavity begins to expand. (1, 2).

While this is of little significance (besides being a annoyance to the general surgeon) in abdominal surgery, it is of utmost importance in neuro-surgery. (3) Hunter cautioned the use of N_2O in patients undergoing air ventriculograms, stating that the subsequent rises in intra-cranial pressure may be sufficient to cause disturbances in vital functions. (4) Siadman and Eger (5) and Gordan and Grietz (6) noted similar changes in intra-cranial pressure. Cardiac arrest due to tension pneumocehalus developing during neurosurgery has also been described. (7)

The use of continuous intra-venous anaesthetics seem to be a viable alternative to the use of N_2O during anaesthesia. Initially, continuous intra-venous anaesthetic infusion technqiues were used in an effort to minimise theatre pollution. Drugs like Thiopentone and Methohexitone were used but found to be unsuitable because of the accummalative effects and because of cardiovascular depression. With the introduction of Althesin, a steroidal anaesthetic, these difficulties were overcome. (8)

Althesin, besides being an anaesthetic induction agent, has been shown to reduce cerebral metabolism, decrease cerebral blood flow and reduce intra-cranial pressure. (9, 10, 11) Its safe use as the sole anaesthetic agent in neuro-anaesthesia has been demonstrated. (12) Recovery from Althesin is also rapid . Jago and Restall mention mean recovery times of 7.33 min. after cessation of the Althesin infusion irregardless of the total dose of Althesin used. (13) Saady, using doses of 0.10 ml/Kg/hr. to 0.20 ml/Kg/hr. reported recovery times of less than 5 min. (14)

In this particular case, Althesin infusion seemed to be the ideal anaesthetic choice. The use of N_2O and its inherent dangers of expanding the air pockets trapped intra-cranially were avoided. Althesin contributed to the control of intra-cranial pressure throughout the course of operation while keeping the patient anaesthetised. Recovery from anaesthesia after cessation of the intravenous infusion was rapid, thus permitting early neurological assessment. Furthermore a rapid return of laryngeal reflexes was also highly desirable since the patient had serious mandibulo-facial injuries.

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